

Sanctuary Ecologically Significant Area (SESA)

SESA 11: Sur Ridge

Description

SESA 11 includes a large rocky feature, Sur Ridge, and the surrounding area on Sur Slope. Though it includes a wide depth range (817-1,569 m), this SESA has low habitat richness (2 habitats) and habitat diversity (index =1.56) because it includes hard (16%) and soft substrate in only one depth zone (slope 2). Recent cruise research expeditions have contributed to geologic and oceanographic surveys, and biological characterization. Groundfish trawl surveys on the soft bottom surrounding Sur Ridge have captured a few structure-forming invertebrates (sea pen, gorgonians, black and soft corals) and a fish fauna of intermediate richness (mean=13.5 species) and diversity (mean index=1.53). Water upwelled at Point Sur is likely to be advected through this SESA. The water over this SESA has relatively low primary productivity and has low likelihood of being a krill hot spot. The eastern side of the SESA is part of a marine mammal foraging hotspot. This SESA is located within MBNMS, and research activities may require a permit (http://montereybay.noaa.gov/resourcepro/permit/permits_need.html).

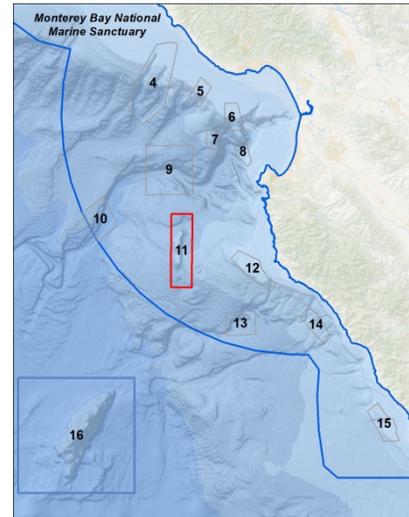


Figure 1. The location of SESA 11 and twelve additional SESAs in Monterey Bay National Marine Sanctuary. Credit: Chad King/MBNMS.

Resource Management Issues

Commercial and recreational human activities can be beneficial or harmful depending on rate and disturbance type, e.g., benthic trawling, vessel traffic, dredging.

- NPS cable
- Commercial bottom trawling
- Essential Fish Habitat (EFH) Conservation Area
- Commercial shipping lane
- Recreational fishing
- Wildlife viewing
- Coral restoration
- EFH bottom trawl closure proposed (2013)
- Leatherback sea turtle critical habitat
- Ocean acidification

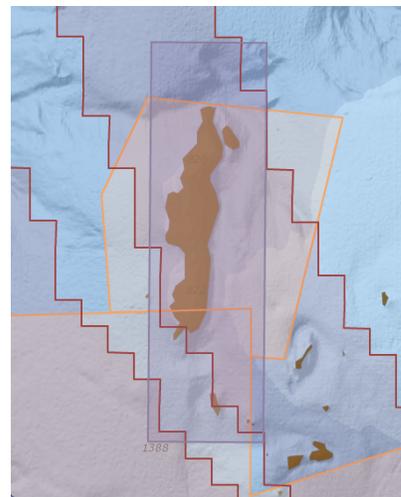


Figure 2. Close-up map of SESA 11. Grey=SESA boundary; orange=EFH Conservation Area; red=Dominant commercial shipping lane. Source: SESAs Interactive Map, <http://sanctuarymonitoring.org/maps/sesa/>.

Living Marine Resources & Uses

Table 1. Species known to occur within SESA 11: Sur Ridge

Invertebrates	<ul style="list-style-type: none"> -sponges† (Porifera) -black corals† (Antipatharia) -stony corals† (Scleractinia) -soft corals† (gorgonians), e.g., bubble gum and bamboo -sea pens† (Pennatulacea), e.g., Virgulariidae, Anthoptilidae -sea slugs (Nudibranchia) -cold seep clams (Vesicomid) -octopi (Cephalopoda) -red galatheid crabs, squat lobsters (Galatheidae) -sea stars (Asteroidea) -brittle stars (Ophiuroidea) -deep-sea fragile urchin (<i>Strongylocentrotus fragilis</i>) (NMFS West Coast Bottom Trawl Groundfish Surveys) <p>For complete list see "Sur Ridge Taxonomic Guide," Burton and Kuhn (In Prep.)</p>
Fishes	<ul style="list-style-type: none"> -Shortspine Thornyhead (<i>Sebastolobus alascanus</i>) -Blob Sculpin (<i>Psychrolutes phrictus</i>) <p>For complete list see "Sur Ridge Taxonomic Guide," Burton and Kuhn (In Prep.)</p>
Marine birds	<ul style="list-style-type: none"> -Buller's Shearwater (<i>Puffinus bulleri</i>) -California Brown Pelican (<i>Pelecanus occidentalis californicus</i>) -Western Gull (<i>Larus occidentalis</i>) -Black-legged Kittiwake (<i>Rissa tridactyla</i>) -Common Murre (<i>Uria aalge</i>) -Rhinoceros Auklet (<i>Cerorhina monocerata</i>) (Ainley et al. 2012)
Marine mammals	<ul style="list-style-type: none"> -blue whale¹ (<i>Balaenoptera musculus</i>) -humpback whale¹ (<i>Megaptera novaeangliae</i>) -dolphins (Odontoceti), e.g., Risso's dolphin (<i>Grampus griseus</i>), Pacific white-sided dolphin (<i>Lagenorhynchus obliquidens</i>), Dall's porpoise (<i>Phocoenoides dalli</i>) -Northern elephant seal (<i>Mirounga angustirostris</i>) -sea lions (Otariinae), e.g., Stellar sea lion² (<i>Eumetopias jubatus</i>), California sea lion (<i>Zalophus californianus</i>) (NOAA, 2003)
Marine reptiles	<ul style="list-style-type: none"> -leatherback sea turtle¹ (<i>Dermochelys coriacea</i>) (NOAA, 2003)

Special Status Species: Endangered¹, Threatened²;
Biogenic habitat†

Diverse or productive communities:

- low primary productivity
- marine mammal foraging hotspot

Migration, breeding, or foraging areas:

- Dall's porpoise, sea lions, dolphins, blue whale, and humpback whale (ESI, Environmental Sensitivity Index)
- 100% in leatherback sea turtle NMFS critical habitat

Research

SIMoN projects:

CSCAPE: Collaborative Survey of Cetacean Abundance and the Pelagic Ecosystem (2005-07)

<http://sanctuarysimon.org/projects/100273/cscape%3a--collaborative-survey-of-cetacean-abundance-and-the-pelagic-ecosystem>

Sea Turtle Restoration Project: Leatherback Watch Program (2010-current)

<http://sanctuarymonitoring.org/projects/100395/sea-turtle-restoration-project%3a-leatherback-watch-program>

Structure of Populations, Levels of Abundance and Status of Humpbacks (SPLASH) (2004-current)

<http://sanctuarymonitoring.org/projects/100224/structure-of-populations%2c-levels-of-abundance-and-status-of-humpbacks-%28splash%29>

Tagging of Pacific Predators (TOPP) (2000-current)

<http://sanctuarymonitoring.org/projects/100137/tagging-of-pacific-predators-%28topp%29>

Tracking Black-footed Albatross Movements and Conservation (2004-08)

<http://sanctuarysimon.org/projects/100305/tracking-black-footed-albatross-movements-and-conservation>

Underwater Behavior of Large Whales Using Suction-cup Attached Tags (2000-current)

<http://sanctuarymonitoring.org/projects/100153/underwater-behavior-of-large-whales-using-suction-cup-attached-tags>

usSEABED: A USGS Pacific Coast Offshore Surficial Sediment Data and Mapping Project (2005-current)

<http://sanctuarymonitoring.org/projects/100247/usseabed%3a-a-usgs-pacific-coast-offshore-surficial-sediment-data-and-mapping-project>

Monitoring stations and/or data collection instruments:

- NMFS West Coast Bottom Trawl Groundfish Survey

MBNMS research:

- CTD profile (NOAA Ship Shimada, 2015)
- Mid-water fish trawl (NOAA Ship Shimada, 2015)
- Coral transplant experiments (MBARI, 2015)
- Biological characterization (MBARI ROV surveys, 2013 and 2014)

Science Needs & Research Questions

Bottom Trawling: Habitat and Species Recovery

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_extraction_trawling.pdf

- Which habitats are sensitive to bottom trawling?

Habitat Characterization of the Continental Slope

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_characterization_slope.pdf

- What are the distribution and abundance of organisms and habitats on the continental slope?
- How do corals and chemosynthetic communities on the continental slope provide biogenic habitat for other species?

Human Health - Harmful Algal Blooms

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_habs.pdf

- How do HABs affect local species populations?

Impacts on Whales from Human Uses

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_whale_science.pdf

- What are the spatial and temporal patterns of habitat use of large whales throughout sanctuary waters (both inshore and offshore)?

Socioeconomics and the Human Dimension

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_socioeconomics.pdf

- How do we determine the overall impact of multiple human activities (some with negative and some with positive influence) on Sanctuary resources?

Water Quality Integrated Analyses

http://sanctuaries.noaa.gov/science/assessment/pdfs/mbnms_water_quality.pdf

- Determine and implement the necessary monitoring to assess the condition of water quality in the Sanctuary.

SESAs Interactive Map: <http://sanctuariesimon.org/maps/sesa>

Publically Available Imagery

- SIMoN Photo Library (<http://sanctuariesimon.org/photos/index.php>)

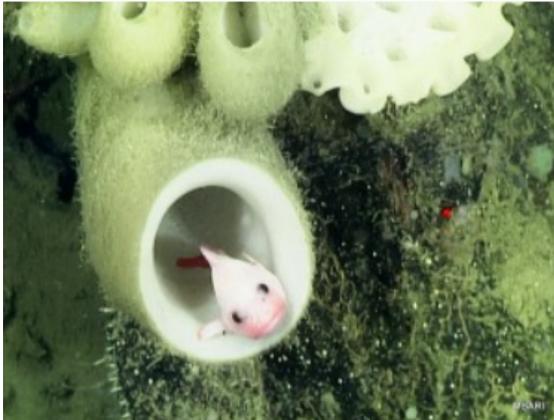


Figure 3. Snailfish (*Liparidae*) rests inside of a sponge near the summit of Sur Ridge. Credit: MBARI (<http://sanctuariesimon.org/photos/index.php>).

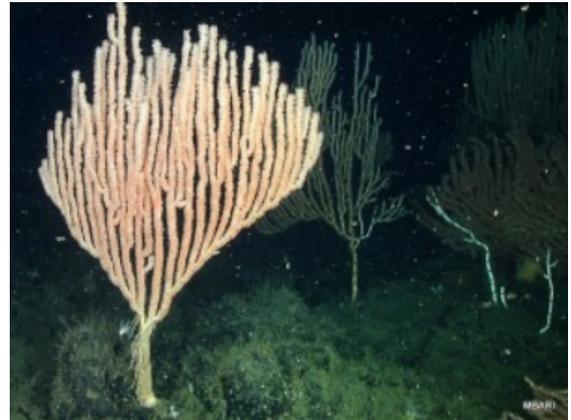


Figure 4. Bamboo coral (*Isididae*) is an upright branching soft coral that acts as a foundation species for other benthic megafauna. Credit: MBARI (<http://sanctuariesimon.org/photos/index.php>).



Figure 5. Bubblegum coral (*Paragorgia arborea*) extending out from cliffs into the uprising currents so the colony of polyps can feed. Credit: MBARI (<http://sanctuariesimon.org/photos/index.php>).

SESA Data Layers

Table 2. The 13 SESAs of the MBNMS are comprised of a variety of biological and environmental characteristics that describe unique pelagic and benthic deep sea communities. Listed are a subset of these qualities which include habitat diversity (Shannon-Wiener diversity index); hard substrate area coverage (%); the most common type of habitat; the presence and abundances of corals and sponges, demersal fishes, and marine birds; and the area coverage (%) of upwelling zone within each SESA. Sources: Draft MBNMS report in preparation; SESAs Interactive Map, <http://sanctuarymonitoring.org/maps/sesa/>.

SESA	Habitat diversity (H')	Hard substrate (%)	Primary habitat	Corals & sponges	Demersal fishes	Marine birds	Upwelling zone (%)
4	5.43	8%	Slope 2 soft canyon	yes-high	yes-high	yes-high	yes-50%
5	6.13	19%	Slope 1 Soft Canyon	yes- high	yes-med	yes-med	yes-100%
6	6.62	13%	Shelf Break soft	yes-high	yes-low	yes-med	no
7	3.52	9%	Slope 2 soft canyon	yes-med	yes-high	yes-med	no
8	5.32	33%	Slope 2 soft canyon	yes-med	yes-med	yes-high	no
9	2.34	5%	Slope 2 soft canyon	yes-high	yes-high	yes-low	no
10	3.23	1%	Rise soft canyon	yes-med	not sampled	yes-low	no
11	1.56	16%	Slope 2 soft	yes-med	yes-high	yes-low	no
12	4.17	32%	Shelf hard	yes-med	yes-high	yes-med	yes-50%
13	2.00	0%	Slope 2 soft	yes-low	not sampled	yes-low	no
14	2.41	0%	Slope 1 Soft	yes-med	yes-high	yes-med	yes-50%
15	5.31	18%	Shelf Break soft	yes-med	yes-med	yes-med	yes-25%
16	3.12	73%	Slope 2 hard	yes-high	yes-high	yes-low	no

Selected Publications

Ainley D, Spear L, Casey J, Ford RG, Gill T, et al. 2012. Chapter 3: Biogeography of Marine Birds. A Biogeographic Assessment off North/Central California. Retrieved from Center for Coastal Monitoring and Assessment (NCCOS), National Ocean Service. <http://ccma.nos.noaa.gov/ecosystems/sanctuaries/california/html/birds/>

Andrew RK, Howe BM, Mercer JA. 2002. Ocean Ambient Sound: Comparing the 1960s with the 1990s for a receiver off the California Coast. *Acoustics Research Letters Online* 3:65-70, doi:10.1121/1.1461915.

Benson SR, Forney KA, Harvey JT, Carretta JV, Dutton PH. 2007. Abundance, Distribution, and Habitat of Leatherback Turtles (*Dermochelys coriacea*) Off California, 1990– 2003. *Fishery Bulletin*, 105(3): 337-347. Available at: http://aquaticcommons.org/8876/1/benson_Fish_Bull_2007.pdf
<http://montereybay.noaa.gov/research/techreports/trbenson2007.html>.

Brown JA, EJ Burton, S De Beukelaer. 2013. The Natural Resources of Monterey Bay National Marine Sanctuary: A Focus on Federal Waters. Marine Sanctuaries Conservation Series ONMS-13-05. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Office of National Marine Sanctuaries, Silver Spring, MD. 264 pp. Available at: <http://montereybay.noaa.gov/research/techreports/trbrown2013.html>

Greene HG, Maher NM, Paull CK. 2002. Physiography of the Monterey Bay National Marine Sanctuary and Implications About Continental Margin Development. *Marine Geology*, 181(1-3): 55-82.

Hall RA, Glenn SC. 2011. Internal Tides in Monterey Submarine Canyon. *Journal of Physical Oceanography*, 41(1): 186-204.

Harvey JT, Raum-Suryan KL, Suryan RM. 1996. Distribution and Abundance of Marine Mammals Near Sur Ridge, California, The Former Proposed Site of the Acoustic Thermometry of Ocean Climate (ATOC) Sound Source (96-2). *Moss Landing Marine Laboratories Technical Publication*: 1-37.

Neander DO. 2002. Analysis of Temperature Variability Between Davidson Seamount and Sur Ridge: The Tomographic Inverse Problem. Master of Science Thesis. Naval Postgraduate School, Monterey California. 1-59.

NOAA National Centers for Coastal Ocean Science (NCCOS). 2003. A Biogeographic Assessment off North/Central California: To Support the Joint Management Plan Review for Cordell Bank, Gulf of the Farallones, and Monterey Bay National Marine Sanctuaries: Phase I - Marine Fishes, Birds and Mammals. Prepared by NCCOS's Biogeography Team in cooperation with the National Marine Sanctuary Program. Silver Spring, MD 145 pp.

Normark WR and Gutmacher CE. 1988. Sur Submarine Slide, Monterey Fan, Central California. *Sedimentology*, 35(4): 629.

Onofre JA. 1999. Analysis and Modeling of the Acoustic Tomography Signal Transmission From Davidson Seamount to Sur Ridge: The Forward Problem. Master of Science Thesis, Naval Postgraduate School, Monterey, California. 1-53.

Rago T, Collins CA, Chiu CS, Worcester P, Castro CG. 2000. Oceanographic Data from Sur Ridge (36.3°N, 122.4°W) to Hoke Seamount (32.1°N, 126.9°W), May 1999. *Naval Postgraduate Report*.

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Tseng YH and Breaker LC. 2007. Nonhydrostatic Simulations of the Regional Circulation in the Monterey Bay Area. *Journal of Geophysical Research* 112, C12017, doi:10.1029/2007JC004093.

Tseng YH, Dietrich DE, and Ferziger JH. 2005. Regional Circulation in the Monterey Bay Region: Hydrostatic Versus Nonhydrostatic Modeling. *Journal of Geophysical Research* 110, C09015, doi:10.1029/2003JC002153.

Watters DL, Yoklavich MM, Love MS, Schroeder DM. 2010. Assessing Marine Debris in Deep Seafloor Habitats off California. *Marine Pollution Bulletin*, 60(1), 131-138.